Attachment 8: Quality Assurance

Quality assurance (QA) is an overall management plan used to guarantee the integrity of the data and analysis performed. This includes the following guidelines for:

- Procedural Assurances
- Personnel Qualifications
- Test-hole/Monitoring Well Design, Construction, and Development
- Groundwater Level Measurements
- Groundwater Quality Sampling

Quality control (QC) is a component of QA that includes analytical measurements used to evaluate the quality of data collected. The following sections outline specific QA/QC protocol to be followed for the proposed project.

Procedural Assurances

The proposed work effort will be executed according to clearly delineated lines of authority. Steven Lederer, Director of Napa County Public Works will serve as the project director. Richard M. Thomasser will administer the grant agreement on behalf of Napa County to ensure that the work is performed in accordance with terms defined in the contract. Mr. Thomasser is Operations Manager for the Napa County Flood Control and Water Conservation District (Flood District) and is a registered Professional Geologist. Jeff Sharp, Principal Planner, for Napa County Public Works, will serve as day to day project manager. Much of the work to be performed will be contracted by the County to Luhdorff and Scalmanini, Consulting Engineers (LSCE). As a result, with oversight by the County, LSCE will manage and perform specific tasks within the project work plan. Vicki J. Kretsinger Grabert will serve as LSCE project leader including performing the following functions for the project:

- Coordination of project activities;
- Day-to-day direction of project staff;
- Formal and informal communications and reporting to DWR; and
- Assurance/oversight of overall quality and quantity of the information obtained.

In addition to project oversight and review provided by the County, LSCE will follow its own internal structure for project management, performance, and internal review. This includes oversight of project related tasks by a California Professional Engineer and/or Geologist as appropriate.

Consultant Qualifications

Much of the technical work on this project would be performed by Luhdorff and Scalmanini, Consulting Engineers (LSCE). LSCE is a consulting and services organization that for 30 years has dealt exclusively with the investigation, development, use, protection and management of water resources. The firm’s main office is located in Woodland, CA; LSCE has 28 staff members, 24 of which are scientists and engineers. The firm's primary focus has been to address the extent, availability, and quality of groundwater resources and the development of groundwater supply on behalf of numerous public agencies and private entities. LSCE's clients include a large range of municipalities, water districts, other public agencies, and corporate and private interests throughout California and other western states. In recent years, there have been increasing stresses on water systems to meet growing demands. LSCE has assisted hundreds of clients with the design and installation of new wells and pump stations to increase water supply. LSCE also provides engineering design and construction services for groundwater blending facilities with treatment plants, storage and pipelines, and aquifer storage and recovery (ASR) facilities.

LSCE has provided technical analyses on the topic of groundwater and surface water interaction for various objectives. LSCE has designed and implemented groundwater-surface water interaction monitoring as part of determining the feasibility of recapturing reservoir releases along Alameda Creek using groundwater levels, stream stage levels, aquifer testing, and aquifer diffusivity analyses. LSCE has also been involved in determining the impact to groundwater from installation of slurry cutoff walls in the context of levee improvement along the Sacramento, Yuba, Feather, and Bear Rivers in Northern California using groundwater and surface water levels, as well as a numerical model. LSCE has experience with optimizing wells that are completed in aquifers under the direct influence of surface water. LSCE also conducted a study to determine whether groundwater elevations would be a useful tool to estimate streamflow in Lower Putah Creek (Solano County). LSCE produced a technical memorandum for Napa County providing guidance on precipitation and streamflow monitoring activities in the county which included a discussion of near-stream groundwater level monitoring for assessing surface water and groundwater interactions.

LSCE serves as technical expert for the San Bernardino County Superior Court in its continuing jurisdiction over the adjudicated Chino Basin. LSCE serves as engineering and hydrogeologic consultant to the Santa Maria Valley Water Conservation District in the ongoing conjunctive use of conserved surface water and local groundwaters to maintain perennial yield. LSCE also serves as technical expert in the current adjudication of water rights in that coastal basin.

Another arena of current groundwater and surface water activity involves conjunctive use and/or the priority of rights to pump in several basins of varying size, geologic and hydrologic complexity, and degrees of groundwater management. LSCE is currently involved in identification of the occurrence of groundwater in several different basins as a technical basis for defining the applicable groundwater rights, and consequently the priority of pumpers in those basins. Integrated with those analyses are the potential impacts on the aquifer system of existing or planned conjunctive use projects involving State Water Project water, local surface waters, and/or reclaimed water (in some cases "discharged" via groundwater recharge, in another case planned for direct aquifer injection). The ultimate intent of several of these analyses is to modify local groundwater management plans to incorporate recharge components, including groundwater banking, to increase basin yield and/or protect or improve basin quality.

LSCE has developed and reviewed many groundwater flow and transport models, including, on behalf of Napa County. LSCE provided Napa County with recommendations for improving modeling tools used to simulate groundwater and surface water conditions and interrelationships on regional and local scales in the County. LSCE is familiar with the DWR California Statewide Groundwater Elevation Monitoring Program (CASGEM). LSCE provided comments to DWR on the Draft *CASGEM Procedures for Monitoring Entity Reporting* and Draft *DWR Groundwater Elevation Monitoring Guidelines* http://www.water.ca.gov/groundwater/casgem/comments.cfm. LSCE has also made recommendations to and/or assisted local entities in applying to become a CASGEM Monitoring Entity for a county or region, including Napa County.

LSCE is recognized for its thorough and comprehensive analyses of groundwater resources on a regional scale, many of which later become the foundation for further work by LSCE or others. LSCE responds to critical client deadlines, regulatory deadlines, and other time-sensitive requirements such as those that link to grant funding timelines. LSCE is attentive to project budgets and manages budgets by assigned tasks on monthly or more frequent intervals. Clients are alerted when clients request out of scope work and additional funds are needed to complete the task(s) and/or full project to the client's satisfaction.

Personnel Qualifications
Key Napa County Project Personnel

Richard M. Thomasser, P.G., Operations Manager, Napa County Flood Control and Water Conservation District
Richard Thomasser serves as the Operations Manager for the Napa County Flood Control and Water Conservation District (Flood District), a position he has held since December 2005. Mr. Thomasser will serve as project leader on behalf of Napa County. He is a registered Professional Geologist in California and has over 27 years of management experience at the Flood District and as a consultant conducting groundwater and other environmental investigations. As Operations Manager at the Flood District, Mr. Thomasser is responsible for the oversight of the operations and maintenance of the Napa Flood Project lands and constructed facilities. He manages the countywide watershed maintenance program in Napa County, a program funded through a parcel tax assessment and designed to maintain flood control channels as well as natural waterways within the County. He also manages County projects related to the Napa River and tributary restoration and or flood control that are funded using local Measure A taxes. Mr. Thomasser oversees the Countywide Groundwater Monitoring program and the County's CASGEM program.

Phillip Miller, P.E., Deputy Director, Napa County Department of Public Works
Mr. Miller serves as the Deputy Director of Public Works for Flood Control and Water Resources for Napa County and District Engineer for the Napa County Flood Control and Water Conservation District. Mr. Miller is a California registered Professional Engineer with over 36 years of experience in the planning, design, construction and operation of all forms of public water facilities. He spent 20 years in the private sector with a major consulting firm and has spent the last 16 years managing water resources for public agencies.

Key LSCE Personnel

Vicki J. Kretsinger Grabert, Principal Hydrologist, LSCE

Vicki Kretsinger will serve as the LSCE project leader. She is the President of Luhdorff & Scalmanini, Consulting Engineers and Principal Hydrologist and is a registered Professional Hydrologist with the American Institute of Hydrology. Ms. Kretsinger has 29 years of professional experience in groundwater hydrology and quality including investigation, design, evaluation, reporting, and implementation of regional and site specific groundwater monitoring and remediation programs. She has broad experience with geochemistry in relation to groundwater flow, including mass transfer processes and migration and accumulation mechanisms occurring along groundwater flow paths. Ms. Kretsinger has provided technical assistance for projects including water supply assessments of groundwater resources in foothill, mountainous, valley and coastal areas of California; designing and implementing groundwater monitoring networks to characterize regional groundwater quality and resources; and development of sampling, monitoring and analytical protocol and quality control/quality assurance programs.

Nicholas. A. Watterson, Senior Hydrogeologist

Mr. Watterson has over 13 years of experience studying surface and groundwater hydrology in research and consulting environments. He has expertise in the application of geospatial analytical and modeling techniques to characterize surface and groundwater resources and evaluate historic and future change. Mr. Watterson's experience includes quantification of groundwater supply and aquifer storage capacity and assessment of the vulnerability of groundwater resources to contamination. He has additional experience in characterizing aquifer and well mechanics, well construction design, well rehabilitation program design and implementation, and evaluation of groundwater-surface water interactions.

Scott Lewis, P.G., Senior Geologist

Mr. Lewis is a registered Professional Geologist with over 13 years of experience in hydrogeology. His experience in water resources and groundwater development includes site evaluations and exploration drilling, hydrogeologic assessments, monitoring well and production well design, well construction and testing oversight, water well rehabilitation and overall project management. Mr. Lewis specializes in the design and construction of monitoring and municipal water wells. He has experience with over sixty municipal water well projects and over eighty exploration programs.

Kenneth W. Utley, P.G., C.E.G., Senior Geologist

Mr. Utley has 33 years of experience in engineering geology including definition of geologic and lithologic features in groundwater basins; investigation and definition of areal and vertical extent of aquifers; development of geologic and lithologic descriptions from formation samples and geophysical logs for groundwater development and groundwater contamination studies; investigation of erosional processes, landslides, and stream hydrology; and design and implementation of erosion-control projects on steep mountainous terrain; detailed soil and sedimentary mapping for seismic safety.

Barbara Dalgish, P.G., Project Hydrogeologist
Ms. Dalgish has 12 years of professional experience as a hydrogeologist and hydrologist in the private and public sectors. Her experience includes development and construction of site specific and regional groundwater flow models; investigation and assessment of regional geologic and hydrologic conditions for groundwater resource management programs; collection and evaluation of soil, surface water, and groundwater quality; and aquifer parameter estimation.

Casey Meirovitz, Staff Hydrogeologist
Mr. Meirovitz has seven years of experience, including three years experience in groundwater and geologic consulting with LSCE and four years of prior experience as a Research Assistant for the University of California at Davis and as a geologist for a consulting firm in Utah. His experience includes the design and development of geostatistical and groundwater flow models; development and construction of groundwater monitoring networks; investigation and assessment of regional geologic and hydrologic conditions; evaluation of groundwater/surface water interactions; preparation of a Groundwater Management Plan; collection and evaluation of lithologic cores and groundwater samples; and aquifer parameter estimation.

Reid Bryson, Staff Hydrogeologist
Mr. Bryson has four years experience, including performing groundwater and geologic consulting with LSCE and contaminant transport investigations as a Research Assistant for the University of California at Davis. Additional, related experience includes five years of prior experience performing surface water quality monitoring in Northern California. His experience includes the design and development of groundwater flow models; investigation and assessment of regional geologic and hydrologic conditions; collection and evaluation of groundwater samples; aquifer parameter estimation; development and construction of surface water monitoring networks; evaluation of physical and chemical groundwater/surface water interactions; and preparation of a Quality Assurance Project Plan.

Lisa A. Lavagnino, Staff Hydrogeologist
Ms. Lavagnino seven years of experience in geology, groundwater, and geographic information systems. Her experience includes several aspects of hydrogeologic investigation and characterization, including organizing, maintaining, and reporting spatial and temporal data using databases and specialized groundwater software, performing well and aquifer testing and interpreting results, conducting field surveys, and assisting in the formulation and reporting of a groundwater budget through the accounting of metered water use and determination of unmetered water use.

Other LSCE professionals and support staff will be available to assist with this project as needed.

Task-Specific Quality Assurances
Reports and Data Publication

In coordination between Napa County and LSCE, all reports and other formalized publication of results for this project will undergo internal and peer-review processes. Technical products created by LSCE will undergo an internal LSCE review process consisting of review by at least one Professional Geologist in addition to other LSCE reviewers. Draft products will further undergo review by Napa County before being provided to DWR for review and comment. The approach for assuring quality on the project tasks as outlined in the Work Plan includes the components listed below.

Monitoring Well Design, Construction, and Development

In coordination with Napa County, the approach for monitoring well construction oversight on this project would include (but not be limited to) site visits, inspections, construction meetings, review of submittals, responding to requests for information, and assisting with change order request administration. Typical tasks during the construction period are listed below:

Pre-Construction Services

- Development of formal specifications for construction related activities.
- Coordination of pre-bid conference to answer questions of prospective bidders in order to eliminate uncertainties regarding pending construction procedures and requirements. Such conferences frequently reduce uncertainties and consequently result in a more competitive bidding process.
- Assistance with solicitation of competitive bids from qualified, licensed contractors; respond to questions during the bid period; evaluate bids and provide recommendation for contract award.
- Review submittals required from contractor, including a construction schedule, site plans, report forms, list of supervisory personnel. The review ensures the contractor's compliance with the plans and specifications, and any required coordination with other contractors.
- Participate in preconstruction conference with the selected contractor to review work schedules and confirm that the contractor understands the intent of the contract documents. Include final site visitation with the contractor as a part of the conference to review site access and to address questions of the contractor prior to equipment arrival.
- Ensure contractor compliance with labor and equipment requirements and site preparation.
- Provide assistance with construction change orders that may be required to address unforeseen conditions, new information and resolve inconsistencies within the project contract documents.

During Construction

- Inspect surface casing installation and grouting operations.
- Inspect drilling operations and drilling fluid control while drilling through the targeted water production aquifers to ensure minimal formation damage.

- Inspect borehole conditioning and casing installation, including casing welds, alignment, casing guide placement, and screen locations.
- Inspect for proper gravel installation and placement of annular seals (including sanitary seals), as required.

Well Development and Site Cleanup

- Inspect initial well development techniques and final development of the well by pumping.
- Inspect contractor's compliance for site cleanup and securing of well structure.

Field Water Level and Quality Measurements

Manual Measurements

At a minimum, water level measurements will be collected using a *Durham Geo Slope Indicator* electrical sounder (or comparable) at the following frequency:

- Following monitoring well construction and development;
- Two weeks after installation of automated monitoring equipment;
- Monthly as part of the District's existing groundwater monitoring program;
- During quarterly transducer downloads; and
- Prior to groundwater quality sampling.

An electric sounder is used to measure the depth to groundwater from a specified reference point (usually the top of the well casing). Wellhead reference points will be marked to provide consistency between measurements. Measurements are recorded to the nearest 0.01 foot. A field sheet will be used to document the date and time, depth to water (feet), and any comments which may be important for consideration (e.g., nearby well pumping).

Additionally, at surface water monitoring stations, basic field water quality parameters of pH, temperature, and electrical conductivity will be measured at a similar frequency using a *YSI* Model 63 instrument or comparable device.

Automated Water Level, Temperature, and Specific Conductivity Measurements

Automated groundwater and surface water monitoring will be conducted using Instrumentation Northwest CT2X series multi-sensor units installed on vented cables, or comparable instrumentation, with capability to measure water level, temperature, and electrical conductivity. The automated instrumentation will be programmed to collect measurements at 15 minute intervals. Correct operation of the units will be verified and data will be downloaded after two weeks of operation and subsequently every month through the course of the project period. Manual water level and water quality measurements made at the time of each download will be used to verify that the water elevation data and quality data are accurate. After each download, the manual and automated measurements will be reviewed by a Professional Geologist, or other licensed professional, before adding the data to the database.

Water Quality Sampling

This section describes guidelines for the retrieval of water level measurements and water quality samples from dedicated groundwater and surface water monitoring facilities including well purging protocol; instrumentation and its calibration and decontamination; sample handling and recordation; and quality assurance procedures. The sampling procedures employed for this project will conform to the standards of the National Field Manual for the Collection of Water-Quality Data (USGS, 2012).

Water Level Measurements
Water level measurements will be collected in each monitoring well piezometer and each surface water monitoring station prior to sampling. The same procedures for measuring water levels described above will be used during water quality sampling. In groundwater sampling, the water level in conjunction with well construction information is used to calculate the volume of water in the piezometer. This information is used to determine the minimum volume of water to be purged prior to sample collection.

Purging Protocol
Piezometers are to be purged and sampled using a portable submersible sampling pump. Alternatively, it may be elected to use an inertial pump, peristaltic pump, or comparable equipment. A discharge hose is attached to the top of the pump assembly through which purge water is discharged. Smaller-diameter tubing for sample collection is also attached to the top of the pump assembly. Discharge and sample collection tubings are attached to a manifold and are isolated from each other by a check valve.

Piezometers are purged of at least three wet casing volumes and until indicator parameters have stabilized prior to sample retrieval. Stabilization is defined as three consecutive readings at 5-minute intervals where parameters do not vary by more than 5 percent. Purged groundwater is disposed of by spreading it on the ground at a reasonable distance from the sampled well to avoid the potential for purge water to enter the well casing again during the purging process.

At least the following indicator parameters are monitored during the well purging:

- Temperature (°C)
- pH (standard pH-units)
- Electrical conductivity (TS/cm)

Visual (color, occurrence of solids), olfactory (odor) and other observations (e.g., wellhead conditions, well access, ground conditions, weather) are noted as appropriate.

Instrumentation
The following equipment may be used during purging and sampling activities:

- Purging: submersible pump with discharge hose;
- Sample retrieval: clean food-grade polyethylene tubing (to bypass the discharge

hose);

- Depth-to-water: *Durham Geo Slope Indicator* electrical sounder (or similar);
- pH, temperature, electrical conductivity: *YSI* instrumentation (Model 63) (or similar);
- Turbidity: *Orbeco-Hellige* Model 966 portable turbidity meter (or similar);
- Dissolved oxygen: *YSI* instrumentation (Model 55) (or similar); and
- Oxygen reduction potential: *Oakton ORPTester* (or similar).

Calibration
Field calibration of instrumentation is conducted following the manufacturer's instructions and standard solutions prior to a sampling event and once on every day of the event. The thermometer is factory calibrated and is not field calibrated.

Decontamination
The pump assembly and discharge hosing will be thoroughly flushed with tap water between well visits. If additional analyses are incorporated into the program in the future, decontamination procedures will be appropriately adjusted.

Sample Handling and Recordation
After completion of purging activities, groundwater quality samples are filtered in the field to remove turbidity and collected in laboratory-supplied bottles with or without preservative (depending on analyses to be conducted) without headspace. Bottles are labeled with laboratory-supplied labels, immediately placed on ice, and kept in a dark ice chest (at 4 °C) until delivered to the laboratory. Samples are delivered to a laboratory certified through the State of California (Department of Health Services Environmental Laboratory Accreditation Program) with the proper chain-of- custody documentation within the required holding time. A chain-of-custody (COC) form issued to record sample identification numbers, type of samples (matrix), date and time of collection, and analytical tests requested. In addition, times, dates, and individuals who had possession of the samples are documented to record sample custody.

A field sheet is used to document equipment calibration, water level measurements, well purging activities, and the measurement of indicator parameters (Att#8_LGA12_NapaCnty_QA_2of2).

Laboratory Analyses
Laboratory analyses will be conducted for general chemical constituents of interest, likely minerals, general physical, and drinking water metals. Electrical conductance, pH, and temperature will be measured in the field as a QA/QC measure. **Table 8-1** lists the analytical method, practical quantitation limit, sample containers, preservatives, and holding time for each parameter.

All sampling equipment will be decontaminated prior to sample collection and all field test equipment will be calibrated according to manufacturer's specifications.

Parameter	Analytical Method	Quantitation Limit	Sample Container/Preservatives	Holding Times
TDS	EPA 160.1	10 mg/l	500 milliliter (ml) polyethylene, cool[1]	7 days
Nitrate as nitrogen	EPA 300.0	0.5 mg/l	500 ml, polyethylene cool[1]	2 days
Electrical conductance	EPA 120.1	10 µmhos/cm	500 ml, polyethylene cool[1]	28 days
pH	EPA 150.1	0.01 SU	500 ml, polyethylene cool[1]	1 day
Aluminum	EPA 6020/200.7	50 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Antimony	EPA 6020/200.8	6.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Arsenic	EPA 6020/200.8	2.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Barium	EPA 6020/200.7	100 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Beryllium	EPA 6020/200.8	1.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Cadmium	EPA 1638/200.8	1.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Chromium	EPA 6020/200.7	10 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Copper	EPA 6020/200.7	50 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Cyanide	EPA 9012A	100 µg/l	500-ml polyethylene, NaOH, pH < 14	14 days
Iron	EPA 6020/200.7	100 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Lead	EPA 6020/200.8	5.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Manganese	EPA 6020/200.7	10 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Mercury	EPA 245.2	1.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Nickel	EPA 6020/200.8	10 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Selenium	EPA 6020/200.8	5.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Silver	EPA 6020/200.7	10 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Thallium	EPA 6020/200.8	1.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Zinc	EPA 6020/200.7	50 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Alkalinity (total) as $CaCO_3$	EPA 310.1	1.0 mg/l	1-liter polyethylene	14 days
Bicarbonate Alkalinity as $CaCO_3$	EPA 310.1	1.0 mg/l	1-liter polyethylene	14 days
Carbonate Alkalinity as $CaCO_3$	EPA 310.1	1.0 mg/l	1-liter polyethylene	14 days
Hydroxide Alkalinity as $CaCO_3$	EPA 310.1	1.0 mg/l	1-liter polyethylene	14 days
Calcium	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Chloride	EPA 300	0.25 mg/l	1-liter polyethylene	28 days
Fluoride	EPA 300	0.1 mg/l	1-liter polyethylene	28 days
Foaming Agents (MBAS)	EPA 425.1	0.5 mg/l	1-liter polyethylene	2 days
Hardness (Total) AS $CACO_3$	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Magnesium	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Potassium	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Sodium	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Sulfate	EPA 300	0.5 mg/l	1-liter polyethylene	28 days
Color	EPA 140.1	NA[2]	1-liter polyethylene	2 days
Odor Threshold @ 60 C	EPA 110.2	NA[2]	1-liter glass	1 day
Turbidity	EPA 180.1	0.5 NTU	1-liter glass	2 days

1. A single 500 ml polyethylene bottle will provide sufficient volume for TDS, nitrate, electrical conductance and pH analyses.
2. Not Applicable.

Field Quality Control

"Blind" duplicate field samples are collected to monitor the precision of the field sampling process and to assess laboratory performance. Duplicate samples are collected from at least 5 percent (1 in 20) of the total number of sample locations. The true identity of the duplicate sample is not noted on the COC form, rather a unique identifier is provided. The identities of the blind duplicate samples are recorded in the field sheet, but the sampling locations of the blind field duplicates will not be revealed to the laboratory.

Laboratory Quality Control

Quality assurance and quality control samples (e.g., spiked samples, blank samples, duplicates) are employed by the laboratory to document the laboratory performance. Results of this testing are provided with each laboratory report.

Review of Laboratory Data Reports

Data validation includes a data completeness check of each laboratory analytical report. Specifically, this review includes:

- Review of data package completeness (ensuring that required QC and analytical results are provided);
- Review of the required reporting summary forms to determine if the QC requirements were met and to
- Determine the effect of exceeded QC requirements on the precision, accuracy, and sensitivity of the data;
- Review of the overall data package to determine if contractual requirements were met; and
- Review of additional QA/QC parameters to determine technical usability of the data.

In addition, the data validation includes a comprehensive review of the following QA/QC parameters:

- Holding times (to assess potential for degradation that will affect accuracy);
- Blanks (to assess potential laboratory contamination);
- Matrix spikes/matrix spike duplicates and laboratory control samples (to assess accuracy of the methods and precision of the method relative to the specific sample matrix);
- Internal standards (to assess method accuracy and sensitivity);
- Compound reporting limits and method detection limits; and
- Field duplicate relative percent differences.

References

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, available online at http://pubs.water.usgs.gov/twri9A., accessed July 6, 2012.